# SPECIFICATION

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# PRECISION LOCATION SYSTEM BETWEEN ACTUATOR ACCESSORY AND MECHANISM

## Cross Reference to Related Applications

This application is a continuation of U.S. Patent application No. 09/536,360 filed on March 27, 2000.

## Background of Invention

[0001] The present invention relates to the interface between a circuit breaker operating mechanism and a multipole circuit breaker, and, more particularly, to the precision location of a trip actuator unit mounted on the cover unit and a circuit breaker operating mechanism to trip a multipole circuit breaker.

[0002] In a circuit breaker of a phase cassette concept, the functional relationship between the operating mechanism and the trip actuator unit is such that when the trip actuator unit indicates a trip signal, the actuator must interface with the mechanism at the trip latch to open the breaker. Tolerances in the system hinder this functional relationship. A precision relation must necessarily be established between the circuit breaker operating mechanism and the trip actuator unit.

[0003] In U.S. Patent No. 5,281,776 entitled "Multipole Circuit Breaker With Single-Pole Units", single-pole units of a general box-like parallelepipedic shape are arranged side-by-side and are linked by alignment rods extending perpendicularly through the opposing side faces of each box. Since the internal components of each single-pole unit are framed laterally with a small clearance by the opposing side faces and are free to move slightly in other directions to compensate for irregularities in manufacturing or positioning, a certain amount of tolerance buildup results. Excessive tolerance

buildup may cause the inadequate performance of the circuit breaker.

[0004] In U.S. Patent No. 5,581,219 entitled "Circuit Breaker", the trip actuator unit is in the form of a cassette detachably mounted on a molded base, and the molded base is detachably mounted to a cover of a circuit breaker casing. The cover rests on the casing of the unit, and the trip actuator unit and other accessories are properly located on the breaker by being mounted in recesses formed in the cover.

[0005] Because a precision spatial relationship is required between the trip actuator unit and the breaker operating mechanism for the proper functioning of the circuit breaker, tolerances in the system must be minimized. In order to minimize these tolerances, clearances between parts are eliminated by bringing parts into physical contact with each other and by dimensioning the circuit breaker such that critical components have a direct spatial relationship with other critical components.

## Summary of Invention

[0006] The above discussed and other drawbacks and deficiencies are overcome or alleviated by a precision location system for a circuit breaker utilizing a phase cassette concept. The precision location system is between an actuator accessory and an operating mechanism in the circuit breaker having a cover plate configured to receive the actuator accessory. The cover plate is further configured to receive the operating mechanism and is configured to align the actuator accessory with said operating mechanism when the actuator accessory and operating mechanism are received in said cover plate.

[0007]

In an exemplary embodiment, the cover plate has a first protrusion depending therefrom, which contains an alignment groove configured to engage an alignment rod extending through a plurality of single-pole breaking units to align the same. The alignment groove may or may not conform to the outer shape of the alignment rod. A second protrusion containing an alignment groove may depend from the cover plate to engage the same alignment rod at a different point, thereby providing additional side-to-side securement of the cover plate on the alignment rod. In an alternate embodiment, the alignment grooves may snappingly engage the alignment rods. A location tab disposed on the actuator provides a means for precisely mounting the

actuator on the cover plate, thereby precisely locating the trip actuator unit on the circuit breaker operating mechanism.

[0008] Because the operating mechanism and the actuator accessory are mounted on different components within the phase cassette system, a location system is preferably utilized to precisely define the relationships between all of the components involved. The location system thus allows for a closely toleranced relationship between the cassette and the trip actuator unit by utilizing at least one alignment rod extending laterally through breaking units within the phase cassette assembly.

## Brief Description of Drawings

[0009] FIG. 1 is an exploded isometric view of the circuit breaker showing the precision location system, of the present invention;

[0010] FIG. 2 is an isometric view of an alignment groove, of the present invention;

[0011] FIG. 3 is an isometric view of an alternate embodiment of an alignment groove, of the present invention; and

[0012] FIG. 4 is a side elevated view of the circuit breaker showing the precision location system, of the present invention, fitted to an alignment rod.

## Detailed Description

[0013] Referring to FIG. 1, a precision location system between an actuator accessory and a breaker operating mechanism is shown generally at 10. Precision location system 10 comprises a phase cassette assembly 12 and an actuator (shown below with reference to FIG. 4) operably connected to a breaker operating mechanism 14. Phase cassette assembly 12 comprises at least one breaker unit 16 housed in a base portion 18 having a mid-cover 20 securable to base portion 18. A protrusion 36 having an alignment groove 22 depends from mid-cover 20 and engages a first alignment rod 24 inserted through breaker unit 16 and any adjacent breaker units 17, 19 and breaker operating mechanism 14. Alignment groove 22 engaging alignment rod 24 precisely locates actuator and breaker operating mechanism 14 to ensure that breaker unit 16 and adjacent breaker units 17, 19 will be tripped when the appropriate signal is received.

[0014] To maintain proper alignment between breaker units 16, 17 housed within phase cassette assembly 12, first alignment rod 24 and a second alignment rod 26 are inserted through holes 28 in the sides of breaker units 16, 17, 19. First alignment rod 24 and second alignment rod 26, when inserted laterally through breaker units 16, 17, 19, prevent breaker units 16, 17, 19 from moving laterally relative to each other within phase cassette assembly 12.

[0015] Protrusion 36 having alignment groove 22 depends from an edge of an underside 30 of mid-cover 20 and is dimensioned to fit between breaker units 16, 17. In the preferred embodiment, a second protrusion (not shown) depends from an opposing edge of underside 30 to fit between breaker unit 16 and adjacent breaker unit 19. First alignment rod 24 extending laterally through holes 28 in breaker unit 16 and adjacent breaker units 17, 19 is received by alignment groove 22. The point at which first alignment rod 24 extends through breaker unit 16 is dimensioned from the centerline of an axis of a rotary contact arm (not shown) housed inside breaker unit 16, which functions to break the circuit and interrupt the flow of current in the event an overcurrent occurs. In the final assembly, fasteners 32 are used to secure mid-cover 20 to base portion 18 and a top cover 34 to mid cover 20.

[0016] Referring now to FIG. 2, protrusion is shown generally at 36 and in greater detail. Protrusion 36 depends from underside 30 of mid-cover 20 and includes alignment groove 22. Alignment groove 22 is defined by a surface 38 that conforms to the outer cross sectional surface of first alignment rod 24. As shown, surface 38 is rounded to engage an alignment rod having a circular cross section. When phase cassette 12 is fully assembled, first alignment rod 24 engages surface 38 and precisely locates mid-cover 20 on base portion 18. In a preferred embodiment, protrusion 36 is integrally molded into an underside 30 of mid-cover 20.

[0017] Alternately, an alignment groove may snappingly receive first alignment rod 24. Referring now to FIG. 3, an alternate embodiment of protrusion is shown generally at 136. In such a case, alignment groove 122 comprises two prongs 137 having inner surfaces 138 substantially conforming to an outer cross sectional surface of first alignment rod 24. Typically, since alignment rod 24 is of a circular cross section, inner surfaces 138 of prongs 137 are arcuate. Prongs 137 are positioned to snappingly

receive alignment rod 24 transversely with respect to phase cassette assembly 12.

[0018] Each prong 137 protrudes substantially normally away from the general plane of mid-cover 20. A protruding end of each prong 137 contains a generally rounded surface 140, which facilitates the movement of prongs 137 around alignment rod 24 when mid-cover 20 is closed and alignment groove 122 is forced over alignment rod 24. When prongs 137 of alignment groove 122 are forced to engage alignment rod 24, rounded surfaces 140 force prongs 137 to flex away from each other. Once alignment rod 24 is more than half way into alignment groove 122, rounded surfaces 140 close over alignment rod 24 and prongs 137 flex back toward each other to snappingly retain alignment rod 24 between prongs 137.

[0019] Referring now to FIG. 4, alignment groove 22 is shown fitted over first alignment rod 24 to locate and align mid-cover 20 on phase cassette assembly 12. The position of alignment groove 22 on mid-cover 20 is dimensioned from the center axis of rotary contact arm (not shown) housed inside breaker unit 16. A precision fit between the engagement surface of alignment groove 22 and first alignment rod 24 minimizes the tolerances between breaker units 16, 17 and breaker operating mechanism 14, thereby avoiding tolerance buildup in precision location system 10.

[0020] In precision location system 10, a precision relationship is critical to system performance. Actuator 50 serves to trigger the breaker operating mechanism 14 and trip breaker unit 16, thereby tripping adjacent breaker units 17, 19 and removing power to the circuit. Actuator 50 is mounted on mid-cover 20 and properly aligned thereon by means of an actuator location tab 52. An accurate relationship between actuator location tab 52 and alignment groove 22 on mid-cover 20 is maintained. This, in conjunction with the precision fit between alignment groove 22 and first alignment rod 24, aids in minimizing the tolerance accumulation between actuator 50 and operating mechanism 14. Precision mounting of components ensures the minimization of tolerance accumulation and will ensure that all breaker units are tripped when a signal to do so is received.

[0021] While this invention has been described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope

of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.